

Summary Concentrations of Trace Elements in Bay/Delta Estuary Biota

Trace Element	Concentration (ppm wet weight)					Concentrations Exceeding Alert Levels in Delta ^a	Comments
	Mussel	Clam	Fish	Bird	Seal		
Cadmium	0.11 - 4.91	--	0.03 - 0.48	4.17	<0.06 - 0.33	No, but elevated levels in Bay shellfish	Highly persistent in mammals once accumulated; Highly bioavailable
Copper	0.314 - 4.385	10 - 100	1.3 - 3.0	7.14 - 13.86	3.0 - 8.7	Yes. Levels in some Suisun Bay and Delta fish exceed MIS.	Elevated levels acutely toxic to striped bass; - Says who?
Mercury	0.01 - 0.46	--	0.13 - 0.94	0.16 - 0.6	0.40 - 3.65	Yes. Levels in some Delta fish exceed MIS.	May interact with selenium in biota; Health advisories for consumption of striped bass; Bioaccumulates; Elevated levels in Endangered Clapper Rail may be causing reproductive effects; Reproductive effects in Willets.
Selenium	0.19 - 0.66	0.3 - 1.30	0.28 - 22.0	24 - 58	2.07 - 6.49	No, but elevated levels in Bay shellfish, fish, and ducks	Elevated levels detected in striped bass tissues; Causes bird deformities and reproductive problems; Health advisories for consumption of fish from Kesterson area; Bivalve accumulation in Bay/Delta
Zinc	11.0 - 45.8	--	16.0 - 43.0	21.6	--	No alert levels established for tissue.	Elevated levels detected in striped bass tissues; - Says who?

^a Alert Levels refer to maximum tissue residue levels that are protective of human health. They include:

- 1) the median international standard (MIS), which is a general guideline of what other nations consider to be elevated contaminant levels in fish and shellfish tissue;
- 2) the U.S. Food and Drug Administration (FDA) action levels, which represent maximum allowable concentrations for some toxic substances in human foods;
- 3) the State Department of Health Service's maximum allowable residue levels (MARL), established to ensure that a consumer of specified fish or wildlife species does not exceed the permissible intake level for particular contaminants.

Source: Monroe, Michael W., Judy Kelly, and Nina Lisowski. 1992. State of the Estuary. San Francisco Estuary Project. 270 pp.

TRACELEM.XLS
biota concn
8/16/96

D-032820

Geographic Hot Spots for Trace Element Parameters of Concern

Trace Element	Known Hot Spots	Potential Hot Spots
Cadmium	Sacramento River-Freeport to Hood (2,400 acres); San Joaquin River-Vernalis to Old River (654 acres) <i>Sacramento River - Spring Creek from Keswick dis Redding</i>	Carquinez Strait-Mare Island Strait (10-50 acres); Suisun Bay-Concord Naval Weapons Station (50-250 acres) Peyton Slough (<10 acres); Delta Waterways-Entire (48,000 acres)
Copper	Carquinez Strait/Suisun Bay-Multiple stations including Honker Bay, Peyton, Boynton, Peytonia and Chadbourne Sloughs (>250 acres); Sacramento River-Freeport to Hood (2,400 acres); San Joaquin River-Vernalis to Old River (654 acres) <i>Exceeds Guidelines</i>	Carquinez Strait-Mare Island Strait (10-50 acres); Suisun Bay-Concord Naval Weapons Station (50-250 acres), Peyton Slough (<10 acres); Delta Waterways-Entire (48,000 acres)
Mercury	SF Bay/Delta (>250 acres); Sacramento River Freeport to Hood (2,400 acres)	Carquinez Strait-Mare Island Strait (10-50 acres); Suisun Bay-Concord Naval Weapons Stations (50-250 acres), Peyton Slough (<10 acres); Sample point off Vallejo (<10 acres)
Selenium	Suisun Bay (>250 acres); San Joaquin River-Vernalis to Old River (654 acres)	Suisun Bay-Concord Naval Weapons Stations (50-250 acres)
Zinc	Sacramento River-Freeport to Hood (2,400 acres) <i>Exceeds West-Klamath</i>	Suisun Bay-Concord Naval Weapons Station (50-250 acres); Carquinez Strait Peyton Slough (<10 acres)

Source: SWRCB & RWQCBS. 1993. Status of the Bay Protection and Toxic Cleanup Program Staff Report.

Known toxic hot spot-exceed water or sediment quality objectives, water or sediment exhibit toxicity associated with toxic pollutants, and tissue toxic pollutant levels of organisms collected from the site exceed levels established by OEHHA, FDA, DHA and NAS.

Potential toxic hot spot-sites with existing information indicating possible impairment, but without sufficient information to be classified as "known" toxic hot spot.

Summary Effects of Trace Elements that Occur in the Bay/Delta Estuary

Trace Element	Effects
Cadmium	Carcinogenic/Mutagenic/Teratogenic. Highly toxic in aquatic environments. Bioaccumulates up to 250,000 times concentration in water. Of exceptional toxicity to mammals, including humans.
Copper	Chronically toxic to marine organisms at concentrations in water of 0.01 - 10 ppm. Acutely toxic at concentrations in water greater than 0.1 ppm. Bioaccumulates in shellfish up to 30,000 times concentration in water. Highly bioavailable in the estuary.
Mercury	Teratogenic. Most toxic of all trace elements. Effects occur at low ppb level. Wide range of acute and chronic toxicities to aquatic biota. Bioaccumulates in some aquatic biota at levels 100,000 times that in water.
Selenium	Teratogenic. Toxicity depends greatly on chemical form. Toxic effects occur at concentrations of 10 ppb in freshwater, 1 ppm dry mass in sediments, and 0.3 ppm wet weight in shellfish.
Zinc	Moderately toxic. Chronic toxicity in marine organisms. Acute toxicity to marine and freshwater animals occurs at concentrations in water above 0.1 ppm. Bioaccumulates in shellfish to levels 100,000 times that of water.

in soft water
fish

0.01 mg/L

0.016 mg/L

0.042 mg/L

D-032822

Source: Monroe, Michael W., Judy Kelly, and Nina Lisowski. 1992. State of the Estuary. San Francisco Estuary Project. 270 pp.

Concentrations of Trace Elements in Waters of the Bay/Delta Estuary (ppb)

*Below
Keswick*

Trace Element	Range of Total Concentrations	State Water Quality Objective Upstream of San Pablo Bay	Any Samples Exceeding State Water Quality Objectives?
Cadmium	0.005 - 0.159	1.1 (4D); 3.9 (1H)	No
Copper	0.9 - 7.2	6.5 (4D); 9.2 (1H)	Yes
Mercury	0.001 - 0.032	0.025 (4D); 2.4 (1H)	Yes
Selenium	0.013 - 4.700	--	--
Zinc	1.4 - 17.4	38 (1D); 170 (Inst.)	No

Dashes indicate that either reliable data or water quality objectives do not exist.

4D = Four day average

1H = One hour average

Inst. = Instantaneous value

Source: Monroe, Michael W., Judy Kelly, and Nina Lisowski. 1992. State of the Estuary.

San Francisco Estuary Project. 270 pp.

Concentrations of Trace Elements in San Francisco Bay Sediments (ppm)

Trace Element	Mean	Range
Cadmium	1.06	0.02 - 17.3
Copper	51	1 - 1500
Mercury	0.5	<0.01 - 6.80
Selenium	--	0.001 - 0.035
Zinc	~100	<100 - 1255

*are these 15cm dry weight?
POS conc? worthless w/o
Keswick (50m)*

*11
4,800*

1,600

Dashes indicate that data are not available.

Source: Monroe, Michael W., Judy Kelly, and Nina Lisowski. 1992. State of the Estuary.

San Francisco Estuary Project. 270 pp.

Proposed CALFED Water Quality Actions and Affected Parameters that Impact
Ecosystem Water Quality

Finlayson, Brian

		AFFECTED PARAMETERS																										
ACTION	BENEFIT	METALS										ORGANICS			NUTRIENTS			OTHER										
		Metals	Cadmium	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Zinc	Pesticides (Insecticides, Herbicides, etc.) *	Petroleum Related	Other Organics	Nitrogen (other than Ammonia)	Ammonia	Phosphorous	Arsenic	Dissolved Oxygen (D.O.)	Pathogens	pH	Temperature	Salinity (TDS, EC)	Chloride	Sodium	Suspended Solids (SS)	
1. Expand and extend existing programs to provide incentives for pollution source control on agricultural lands.	Improved instream and Delta water quality.							✓				✓						✓							✓			
2. Establish incentives for retirement of lands with the most severe drainage problems and where cost effective.	Improved instream and Delta water quality, reduces demand for irrigation water.							✓				✓						✓							✓			
3. Manage drainage timing to reduce instream impacts of water quality.	Reduces the concentration of pollutants entering and its tributaries during low flow periods and allows better coordination of discharges and dilution flows.																	✓							✓			
4. Construct wetlands to treat upstream wastewater effluent and Delta agricultural drainage.	Improves Delta water quality by allowing some filtration and reduction in biological oxygen demand to result from constructed wetland treatment.	✓												✓														
5. Increase enforcement of source control regulations for agricultural drainage to moderately: reduce leachate conc. and vol., restrict spray programs adjacent to waterways, reduce runoff vol., reduce concerns of pollutants in runoff.	Reduces in-Delta and tributary surface water concentrations of pesticides (herbicides, fumigants, fungicides), fertilizers, concentrated mineral salts, and microbial agents from agricultural drainage.													✓														
6. Coordinate fallowing or retirement of agricultural lands with severe, costly drainage problems with water supply management actions.	Reduces volume of drainage water and constituent pollutant contributions to Delta and tributary surface waters.							✓				✓						✓							✓			
7. Treat agricultural drainage to remove pollutants, to either be reused or used as part of a localized drainage management practice in coordination with management of drainage timing. (may increase TDS)	Provides additional dilution flows for improving the quality of receiving waters in Delta and to Delta tributaries.							✓				✓						✓							✓			

+ Should segregate - out herbicides, insecticides, and fungicides.

Proposed CALFED Water Quality Actions and Affected Parameters that Impact Ecosystem Water Quality

Finleyson, B. W.

		AFFECTED PARAMETERS																												
ACTION	BENEFIT	METALS								ORGANICS			NUTRIENTS			OTHER														
		Metals	Cadmium	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver		Pesticides (Insecticides, Herbicides, etc.)	Petroleum Related	Other Organics		Nitrogen (other than Ammonia)	Ammonia	Phosphorous		Arsenic	Dissolved Oxygen (D.O.)	Pathogens	pH	Temperature	Salinity (TDS, EC)	Chloride	Sodium	Suspended Solids (SS)	
8. Increase the level of agricultural water conservation to reduce demand.	May improve overall Delta and tributary water quality through retention of agricultural drainage water for release when pulse flows can provide dilution.																													
9. Treat and recycle agricultural drainage for irrigation purposes to reduce export demand where feasible while maintaining appropriate salt leaching requirements.	Can improve Delta and San Joaquin River and export water quality depending on reclamation activity.																													
10. Encourage management of riparian zones to protect water quality by funding a cooperative program in watersheds of reservoirs operated by participating watersheds.	Preserves riparian and aquatic habitats, reduces sedimentation, improves Delta water quality.																													
11. Dilute pollutants in Delta inflows from San Joaquin River using stored water.	Improves Delta water quality by providing a source of manageable dilution flows that can be released during low-flow/high drainage discharge periods.																													
12. Manage water flows and stages down Old River.	Improves water quality in the South Delta.																													
13. Acquire water from willing sellers in the San Joaquin Valley or develop from expanded surface water or groundwater storage.	Improves water quality.																													
14. Improve management of urban stormwater runoff to retain an additional 20 to 30 percent of runoff volume.	Improves Delta water quality by reducing the volume of urban stormwater runoff and concentration of pollutants entering Delta tributaries.																													

Wm. L. G. 1891

D - 0 3 2 8 2 6

Proposed CALFED Water Quality Actions and Affected Parameters that Impact
Ecosystem Water Quality

Emilysen, Brian

		AFFECTED PARAMETERS																										
ACTION	BENEFIT	METALS										ORGANICS			NUTRIENTS			OTHER										
		Metals	Cadmium	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Pesticides (Insecticides, Herbicides, etc.)	Petroleum Related	Other Organics	Nitrogen (other than Ammonia)	Ammonia	Phosphorous	Arsenic	Dissolved Oxygen (D.O.)	Pathogens	pH	Temperature	Salinity (TDS, EC)	Chloride	Sodium	Suspended Solids (SS)		
Ident a comprehensive Delta Long-action Plan at a moderate level.	Reduces vulnerability of Delta water quality to salinity intrusion. Reduces vulnerability of Delta ecosystem functions to salinity intrusion and inundation.																											